CLAIMS

1. An IC element formed integrally with a coil for performing contactless data communication with external equipment, characterized in that a conductor constituting said coil is implemented in a multilayer structure including a metal-sputtered layer or alternatively a metal-evaporated layer and a metal-plated layer.

2. An IC element set forth in claim 1, characterized in that said metal-sputtered layer or alternatively said metal-evaporated layer is formed of at least one metal of aluminum, nickel, copper and chromium or alternatively an alloy containing those metals and that said metal-plated layer deposited on said metal-sputtered layer or alternatively said metal-evaporated layer is formed of copper.

3. An IC element set forth in claim 1, characterized in that said coil is formed on a surface of said IC element formed with input/output terminals with interposition of an electrically insulative surface passivation film and that the input/output terminals of said IC element and said coil are electrically interconnected through through-holes formed in said surface passivation film and each having a diameter smaller than a line width of said coil.

4. An IC element set forth in claim 1, characterized in that said coil is implemented in a rectangular spiral pattern in a planar shape and that

all or some of corner portions of said rectangular spiral pattern are chamfered.

5. An IC element set forth in claim 1, characterized in that said metal-plated layer is formed by resorting to a electroless plating method or alternatively an electroplating method or alternatively a precision electroforming method.

6. An IC element set forth in claim 1, characterized in that a line width of said coil is not smaller than 7 μm, an inter-line distance thereof is not greater than 5 μm and the number of turns thereof is not smaller than 20 turns.

7. A method of manufacturing an IC element, characterized in that said method comprises a step of forming uniformly a metal-sputtered layer or alternatively a metal-evaporated layer on a surface passivation film of a finished wafer manufactured through a predetermined process, a step of forming uniformly a photoresist layer on said metal-sputtered layer or alternatively on said metal-evaporated layer, a step of forming in said photoresist layer a predetermined pattern inclusive of a coil for contactless data communication with external equipment through light exposure and development to thereby expose said metal-sputtered layer or alternatively said metal-evaporated layer through said predetermined pattern, a step of laminating a metal-plated layer on exposed portions of said metal-sputtered layer or

alternatively said metal-evaporated layer through an electroless plating method or alternatively an electroplating method or alternatively a precision electroforming method, a step of eliminating the photoresist layer deposited on said finished wafer, a step of forming a predetermined conductor pattern corresponding to said predetermined pattern by etching said metal-sputtered layer or alternatively said metal-evaporated layer exposed through said metal-plated layer, and a step of obtaining concerned IC elements each formed integrally with a coil by scribing said finished wafer.

8. A method of manufacturing an IC element, characterized in that said method comprises a step of forming uniformly a photoresist layer on a surface passivation film of a finished wafer manufactured through a predetermined process, a step of forming in said photoresist layer a predetermined pattern inclusive of a coil for contactless data communication with external equipment through light exposure and development to thereby expose said surface passivation film in said predetermined pattern, a step of mounting the finished wafer undergone a development processing on a sputtering apparatus or alternatively a vacuum evaporation apparatus and forming a metal-sputtered layer or alternatively a metal-evaporated layer on exposed portions of said surface protection film, a step of eliminating the photoresist layer deposited on

said finished wafer, a step of forming a metal-plated layer on said metal-sputtered layer or alternatively on said metal-evaporated layer by resorting to an electroless plating method or alternatively an electroplating method, and a step of obtaining concerned IC elements each formed integrally with a coil by scribing said finished wafer.

9. An information carrier including a substrate having mounted thereon an IC element formed integrally with an antenna coil for performing data communication in a contactless manner with external equipment, characterized in that said IC element is disposed at a center portion of said substrate in a planar direction perpendicularly to a plane of said substrate.

10. An information carrier set forth in claim 9, characterized in that both of top and bottom surfaces of said IC element are covered with said substrate.

11. An information carrier set forth in claim 9, characterized in that only one surface of said IC element is covered with said substrate.

12. An information carrier set forth in claim 9, characterized in that said substrate is formed in a circular or square planar shape.

13. An information carrier set forth in claim 9, characterized in that said substrate is wholly or partially formed of paper.

14. An information carrier set forth in claim 9, characterized in that said substrate is implemented in

a three-bonded-layer structure including a top member, a bottom member and an intermediate member and that said IC element is accommodated within a through-hole formed in said intermediate member at a mid portion thereof.

15. An information carrier set forth in claim 14, characterized in that said though-hole is formed circularly in a planar shape.

16. An information carrier set forth in claim 9, characterized in that said substrate is implemented in a two-bonded-layer structure including a top member and a bottom member and that said IC element is accommodated within a recess formed in said top member or alternatively in said bottom member at a mid portion thereof.

17. An information carrier set forth in claim 9, characterized in that said substrate is implemented in a single layer structure and that said IC element is accommodated within a recess formed in said substrate at a mid portion thereof.

18. An information carrier set forth in claim 16 or claim 17, characterized in that said recess is formed circularly in a plane shape.

19. An information carrier set forth in claim 9, characterized in that further comprising another discrete coil which is separately formed independent of said IC element internally of said substrate.

20. An information carrier manufacturing method,

characterized in that the method comprises a step of bonding together a first strip material having regularly formed therein a number of through-holes in which IC elements can be inserted, respectively, and a second strip material formed with no through-hole, a step of placing and fixing the IC elements each formed integrally with a coil in said through-holes, respectively, a step of bonding together said first strip material and a third strip material provided with no through-hole, and a step of punching said first to third strip materials bonded unitarily to thereby obtain the concerned information carriers each incorporating said IC element.

21. An information carrier manufacturing method, characterized in that the method comprises a step of placing and fixing coils formed separately independent of IC elements in a number of ring-like recesses formed in a first strip material concentrically around through-holes, respectively, which are formed regularly in said first strip material and capable of accommodating said IC elements, respectively, a step of bonding a second strip material having no through-hole onto one surface of said first strip material, a step of placing fixedly said IC elements each formed integrally with a coil in said through-holes, respectively, a step of bonding together said first strip material and a third strip material having no through-hole, and a step of punching said first to

third strip materials bonded unitarily to thereby obtain desired information carriers each including the IC element and the coil formed separately independent of said IC element.

22. An information carrier manufacturing method, characterized in that the method comprises a step of placing fixedly IC elements each formed integrally with a coil in a number of recesses for accommodating the IC elements, respectively, which recesses are regularly formed in a first strip material, a step of bonding a second strip material having no through-hole onto a surface of said first strip material in which no through-holes are formed, and a step of punching the first and second strip materials bonded unitarily to thereby obtain desired information carriers each incorporating said IC element.

23. An information carrier manufacturing method, characterized in that the method comprises a step of placing fixedly IC elements each formed integrally with a coil in a number of first recesses formed regularly in a first strip material which has second recesses each formed in a ring-like shape concentrically around said first recesses, respectively, said first recesses being capable of accommodating said IC elements, respectively, a step of placing fixedly coils formed discretely independent of said IC elements within said second recesses, respectively, formed in said first strip material, a step of bonding a second strip

material having no through-hole onto a surface of said first strip material in which said recesses are formed, and a step of punching said first and second strip materials bonded unitarily to thereby obtain desired information carriers each including the IC element and the coil formed discretely independent of said IC element.

24. An information carrier manufacturing method, characterized in that the method comprises a step of bonding together a first strip material having a number of through-holes formed regularly and allowing IC elements to be inserted therein, respectively, and a second strip material having no through-hole, a step of placing and fixing said IC elements each formed integrally with a coil in said through-holes, respectively, a step of sealing off said through-holes having said IC elements accommodated therein, and a step of punching the first and second strip materials bonded unitarily to thereby obtain desired information carriers each incorporating said IC element.

25. An information carrier manufacturing method, characterized in that the method comprises a step of placing and fixing coils formed separately independent of IC elements in a number of ring-like recesses formed in a first strip material concentrically around through-holes, respectively, which are formed regularly in said first strip material and capable of accommodating said IC elements, respectively, a step of

bonding together said first strip material and a second strip material having no through-hole, a step of sealing off said through-holes having said coils accommodated therein with a resin, and a step of punching said first and second strip materials bonded unitarily to thereby obtain desired information carriers each including said IC element and the associated coil formed separately independent of said IC element.

26. An information carrier manufacturing method, characterized in that the method comprises a step of placing fixedly IC elements each formed integrally with a coil in a number of recesses for accommodating said IC elements, respectively, said recesses being regularly formed in a strip material, a step of sealing off said recesses having said IC elements accommodated therein with a resin, and a step of punching said strip material to thereby obtain desired information carriers each incorporating said IC element.

27. An information carrier manufacturing method, characterized in that the method comprises a step of placing fixedly IC elements each formed integrally with a coil in a number of first recesses, respectively, which are formed regularly in a strip material having second ring-like recesses formed concentrically around said first recesses, respectively, said first recesses being capable of accommodating said IC elements, respectively, a step of placing fixedly coils formed

discretely independent of said IC elements within said second recesses, respectively, of said strip material, a step of sealing off said first and second recesses with a resin, and a step of punching said strip material to thereby obtain desired information carriers each including the IC element and the coil formed discretely independent of said IC element.

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